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## Parabolar contact lenses compared with conventional contact lenses

Robert W. Brakke  
*Pacific University*

Ronald P. Bussinger  
*Pacific University*

Steven R. Wagner  
*Pacific University*

Steven L. Van Hee  
*Pacific University*

### Recommended Citation

Brakke, Robert W.; Bussinger, Ronald P.; Wagner, Steven R.; and Van Hee, Steven L., "Parabolar contact lenses compared with conventional contact lenses" (1968). *College of Optometry*. 160.  
<https://commons.pacificu.edu/opt/160>

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# Parabolar contact lenses compared with conventional contact lenses

## Abstract

Parabolar contact lenses compared with conventional contact lenses

## Degree Type

Thesis

## Degree Name

Master of Science in Vision Science

## Committee Chair

Don C. West

## Subject Categories

Optometry

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PARABOLAR CONTACT LENSES  
COMPARED WITH  
CONVENTIONAL CONTACT LENSES

CLINIC YEAR THESIS  
SPRING 1968

SUBMITTED BY:

Robert W. Brakke, Ronald P. Bussinger  
Steven R. Wagner, Steven L. Van Hee

In partial fulfillment of the requirement of  
the Doctor of Optometry Degree.

## ACKNOWLEDGEMENTS

We wish to express our appreciation to Fred J. Danker and the Danker and Wohlk Company who supplied us both with information and with the Parabolar Contact Lenses used in our study.

Gratitude is given to Dr. Don C. West, Dr. Colin Pitblado, and Dr. Elizabeth Brody for their help and advice in setting up this experiment. We also wish to thank Dr. Leonard Z. Friedman, from whom the original idea for this experiment was obtained. We wish to thank the patients for the time they gave us.

RWB  
RPB  
SVH  
SRW

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## INTRODUCTION

The idea for this thesis originated with a local optometrist reporting a new type of contact lens, manufactured by the Danker and Wohlk Company, as being more comfortable than a conventional lens of approximately the same dimensions. This lens is known by the trade name, Parabolar.

According to Danker and Wohlk literature, their Parabolar lens has the unique feature of having parabolic-like peripheral curves. These peripheral curves have their center of curvature off the optic axis, such that the normal transition zone, the "blend" area, is all but nonexistent. Danker and Wohlk describes their lens as a "polycurve lens, except for the fact that there are no definite transitions." The peripheral curves are of diminishing power, approximating the shape of a geometrical parabola. "The peripheral curve follows a parabolic effect yet bears a strong resemblance to peripheral curves used on standard lenses."<sup>1</sup>

The lenses themselves are compression-molded into a spherical base curve. The peripheral curve is then lathe cut and is continuous with the anterior surface of the lens. More detailed information on the manufacturing of the lens is available from Danker and Wohlk.

## STATEMENT OF PROBLEM

Our project compared the Parabolar lens with conventional lenses on objective and subjective bases with the only variable being peripheral curves. The conventional lenses had spherical peripheral curves and the Parabolar lenses had the parabolic-like peripheral curves. Special emphasis was made on subjective factors related to comfort.



## APPARATUS

Parabolar contact lenses

Conventional contact lenses

Examination chair

Phoropter

Projector

Slit lamp

Black lamp (u.v. light)

Fluorescein strips

Solutions - wetting, irrigating, and soaking

## PROCEDURE,

Thirty-six full time wearers of contact lenses, selected from the active files of the Pacific University College of Optometry Clinic, were chosen for this study. These subjects were all examined in order to assure that the fit of their present lenses was satisfactory. A pair of lenses of conventional manufacture was prescribed for each subject with the same base curve, power, diameter, and peripheral curves as their present lenses. A pair of Parabolar lenses was also prescribed for each patient using the same base curve, diameter, and power as their present lenses. The preferred peripheral curves were provided by the laboratory manufacturing the Parabolar lenses. The conventional lenses were a #1 gray and the Parabolar lenses were #1 brown in order to facilitate identification of the lenses.

A Parabolar lens was dispensed for the right eye and a conventional lens for the left eye of each subject, which were to be worn for one week. The subjects were told that one of the lenses was the same as their present lenses and the other lens had been manufactured by a different process. The identity of each lens was withheld and the subjects were told to note any differences in their reactions to the two lenses. Instructions for a modified wearing schedule to be used for two days consisted of wearing the lenses for four hours, removing them for one hour, and then wearing them for another four hours. For the remainder

of the week, the lenses were to be worn full time.

The subjects returned after wearing the lenses for one week, and were asked a series of questions concerning lens comfort, a distance red-green finding with spheres only was taken, acuities before and after refraction were taken, the fluorescein pattern was observed, lens movement was noted, and a slit lamp study was made of the corneal tissues.

The subjects were then given a conventional lens for the right eye and a Parabolar lens for the left eye and instructed to follow the same procedure as the previous week. The patients returned and their reactions to the lenses were again evaluated after one week.

The subjective questions asked the subjects are as follows:

1. Do you feel the left lens or the right lens more when you blink?
2. Can you feel the left lens or the right lens more when you lift your lid?
3. Does your left eye or your right eye itch more with your lenses on?  
  
\* If #3 was yes, then #4 was asked.
4. Does itching increase with increased wearing time?
5. Does the vision in your left eye or your right eye become hazy with increased wearing time?  
  
\* If #5 was yes, then #6 was asked.
6. Is this haze decreased by cleaning the lenses?

7. Do you notice more tearing of your right eye or your left eye after wearing the lenses a few minutes?
8. Do you experience a hot or burning sensation with your right eye or your left eye?
9. Does your right or left lens ever slide off the center of your cornea?

The actual recording sheet can be found in the Appendix.

## DATA

The data for the subjective portion of the study is included in table 1. The average wearing time for the subjects was 15 hours per day.

TABLE 1.

<u>QUESTION</u>	<u>PARABOLAR</u>	<u>CONVENTIONAL</u>	<u>NO DIFFERENCE</u>
1.	9	25	34
2.	5	9	54
3.	5	18	45
4.	Yes - 5 No - 4	Yes - 14 No - 0	
5.	5	11	52
6.	Yes - 3 No - 0	Yes - 6 No - 2	
7.	2	6	60
8.	6	12	50
9.	15	4	49
10.	33	21	14

Comparing the pathology of the two different lens designs with the slit lamp resulted in five small dimple stains with the new lenses (three with the Parabolar and two with the conventional) and 135 negative observations.

Dr. R. J. Morrison's method of observing lens position was used in surveying the lag (i. e. #1 position - contact lens rides on the upper limbus, #2 - between upper limbus and center, #3 - on center, #4 - between center and lower limbus, and #5 - on the lower limbal area.) If 1-3 was recorded, the lens was in the #1 position immed-

imately after the blink and then went to the #3 position where it remained until the next blink. This is shown in table 2.

TABLE 2.

POSITION	FREQUENCY	
	PARABOLAR	CONVENTIONAL
1 - 2	4	3
1 - 3	11	14
1 - 4	7	2
1 - 5	1	1
2 - 3	16	11
2 - 4	11	13
2 - 5	5	7
3 - 4	6	5
3 - 5	2	5
4 - 5	1	1
No lag	3	3
Couldn't wear	0	1

As one can see from table 2, the lag and position changes of the different types of lenses are relatively similar.

## STATISTICAL ANALYSIS

For statistical purposes all of the responses of no difference were divided into two and were placed into the categories under Parabolar and conventional. The assumption here is that with a forced choice between Parabolar and conventional, the "no difference" responses would fall equally into both categories. The Chi squared test was used to determine the significance of differences between the two types of lenses on each specific question.

Data from the experiment are presented in Table 3.

TABLE 3.

<u>QUESTION</u>	<u>PARABOLAR</u>	<u>CONVENTIONAL</u>	<u>X<sup>2</sup> SCORE</u>
1.	24	32	3.76
2.	32	36	.24
3.	27.5	40.5	2.50
5.	31	37	.54
7.	32	36	.24
8.	31	37	.54
9.	39.5	28.5	1.78
10.	40	28	2.06

At the .005 level of significance, the critical value of X<sup>2</sup> for df = 1 is 7.88. Thus, no significant difference between the two types of lenses was found on any question.

## DISCUSSION

In setting up this experiment, much thought was given to the clinical relevance of the findings. This thinking governed the approach to the problems and the type of questions that were asked.

The conventional lenses were obtained from Ocular Products of Seattle, Washington. Ocular Products was chosen, with the thinking that their lens was typical of high quality conventional lenses available from any laboratory. Thus an attempt was not made to compare the Danker and Wohlk lens with an Ocular Products lens, rather, the comparison was between the Parabolar lens and any common high quality conventional lens.

Parabolar lenses cannot be modified by standard procedures, thus it was thought to be fair to make the comparison with unmodified conventional lenses. No modifications were made on either lens until the entire testing period was complete. At this time any edge treatment or power changes required were made.

The lens evaluation was divided into 1) subjective questions and 2) an objective evaluation of fit, acuity, slit lamp evaluation, and fluorescein patterns. In an attempt to eliminate the variables between clinicians and between the different times the subjects were seen, the questions were read verbatim. There were several things beyond our control in this type of presentation, but an awareness of them was sought for. The questions were open to interpretation



by each subject. That is, itching to one subject might be entirely different from itching as experienced by another subject. Some of the subjects were completely satisfied with their previous lenses and had no sensation of wearing their lenses before the study began. There was no way of checking, but some of these subjects could have been the kind that could wear almost any kind of lens with the same few problems and lack of sensation which they had previously experienced. The ability of these subjects to tell the difference between lenses would be slight.

One of the best solutions to controlling many variables was that of having the subject wear one lens of a given type on each eye for a period of time, then switching the lenses for the next period of time. Thus each eye would wear each type of lens for an equal amount of time. This would also give the subject a direct comparison between lenses, rather than requiring him to think back to the previous week and try to recall how the lenses felt. If the subject were to come down with a cold or have some other systemic problem, it would affect the different lenses equally. If the right lens were more comfortable both weeks, it could be concluded that the difference was not between types of lenses, but that the fit of the left lens was bad in both types of lenses, or that there was some problem with the left eye only.

An interesting type of fluorescein pattern was observed with the Parabolic lens. Of course the patterns varied from lens to

lens, but several striking features seemed to appear often enough to bear mentioning. The pattern in the area of the optic zone was darker than most standard lenses might have. Instead of the normal light green haze seen commonly, there was little or no color seen centrally. Even though they appeared to have no central fluorescein, it was observed in most cases that immediately after a blink, the tears were very much present behind the area of the optic zone. Yet, within a short time, not over a few seconds, the optic zone went dark. It was difficult to decide whether the optic zone pattern, while present, was comparable with the patterns seen in conventional lenses. The peripheral curve areas generally were more narrow than the corresponding conventional lens, but the depth of pooling in the periphery had no consistent pattern.

Photographs of the different fluorescein patterns are shown below. Both photographs were made approximately 3 seconds after

PARABOLAR



CONVENTIONAL



a blink. The picture of the Danker and Wohlk lens shows the characteristic dark central area and the thin peripheral band. The picture of the corresponding conventional lens shows the central greenish haze and the wide and bright peripheral band. The pictures were made with high speed daylight Ektachrome film and using a Foto-flash Model 1. The camera was set at  $f/8.0$  and  $1/30$  of a second and a K-2 filter was in place.

Evaluation of the tear layer with a slit lamp optic section showed an interesting feature in the area of the blend and peripheral curve. The tear layer of the conventional lenses was narrowed and almost disappeared in the area of the blend. With the Parabolar lens the same narrowing occurred, but it was less narrow and the tear layer was visible under the full length of it. The length of this narrowed area was much less with the Parabolar lens than with the corresponding conventional lens. This feature might be a partial explanation of the easy and rapid flow of tears under the Parabolar lens.

## SUMMARY AND CONCLUSIONS

Thirty-six full time contact lens wearers evaluated two different contact lenses. The two lenses differed only in their peripheral curve design, one being parabolic-like and the other being segments of spheres. Evaluation was made on an objective and subjective basis over a total of a two weeks period.

The statistical evaluation shows no significant difference between the comfort of the Danker and Wohlk Parabolar lens and the comfort of the conventional lens.

Although the data shows no statistical significance, the reader should be informed of the areas of importance to the practitioner. In view of the suggestive numerical results obtained, critical attention should be given to these features of the lens types for future work with them:

- 1) The conventional lens was reported as causing a greater amount of itching and a greater sensation during blinking than the Parabolar lens.
- 2) The Parabolar lens was reported to slip off the center of the cornea more frequently than the conventional lens.
- 3) The patients' subjective evaluation of the over-all comfort of the lenses indicates the Parabolar lens to be the preferred lens by a count of 33 compared to the conventional lenses with 21. No difference in comfort between the lenses was noted in 14 instances.

## REFERENCES

1. Danker, Fred J. and Oriani, Americo, Fitting Manual for Parabolic Corneal Contact lenses, Danker and Wohlk Inc. West Hempstad, New York, 1967.
2. Freund, John E., Modern Elementary Statistics, second edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1960, pp. 278, 283.

APPENDIX

Dear

A new type of contact lens is now available at the Pacific University Optometric Clinic. This lens is of new design and from existing indications it solves many of the problems now faced by the wearer of conventional contact lenses. We are providing these lenses to selected patients for the purpose of a clinical evaluation of them.

If you would like to be a part of this study, you will need to visit the clinic several times, the first being an interview to explain the purpose of the study. If, in our opinion, these lenses are suitable for you to wear, you will be given the pair of lenses free of charge.

In order for us to take up a minimum of your time, we would appreciate your returning the lower portion of this letter to the address given below. If we do not receive a reply within one week, we will assume that you do not wish to participate in the study.

Sincerely,

Bob Brakke, Ron Bussinger, Steven Van Hee  
and Steven Wagner

-----  
Circle one

1. Are you willing to participate in the study described?      Yes      No

2. Are you a full time wearer of contact lenses?              Yes      No

3. Name \_\_\_\_\_

4. Address \_\_\_\_\_

5. Phone Number \_\_\_\_\_

6. If you are willing to participate in the study, would you please indicate all the days and all the times which would be convenient for you to come to the clinic. Please put an "X" in the spaces you are available.

Monday	Tuesday	Wednesday	Thursday	Friday
Morning____	Morning____	Morning____	Morning____	Evening____
Evening____	Evening____	Evening____	Evening____	

Morning times are between 10:00 AM and Noon.

Evening times are between 7:00 and 8:30 PM.

Would you please return the lower portion of this letter to the following address within one week.

Steve Wagner  
2740 22nd Avenue  
Forest Grove, Oregon 97116

CONTACT LENS EVALUATION

PATIENT: \_\_\_\_\_ PHONE: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_ AGE: \_\_\_\_\_

	OZR	OZD	INT	P.C.	BLEND	DIAM	THICK	POWER	COLOR
PREVIOUS	O.D.	_____							
RX:	O.S.	_____							
PARABOLAR	O.D.	_____							
RX:	O.S.	_____							
CONV. RX:	O.D.	_____							
	O.S.	_____							

DATA	DISP.	P.E. #1		P.E. #2		
DATE:						
AVERAGE WEARING TIME:						
1. Do you feel the left lens or the right lens more when you blink?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
2. Can you feel the left lens or the right lens more when you lift your lid?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
3. Does your left eye or your right eye itch more with your lenses on?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
4. Does itching increase with increased wearing time?	YES NO	YES NO	YES NO	YES NO	YES NO	
5. Does the vision in your left eye or your right eye become hazy with increased wearing time?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
6. Is this haze decreased by cleaning the lenses?	YES NO	YES NO	YES NO	YES NO	YES NO	
7. Do you notice more tearing of your right eye or your left eye after wearing the lenses a few minutes?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
8. Do you experience a hot or burning sensation with your right eye or your left eye?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
9. Does your right or left lens ever slide off the center of your pupil?	OD OS NO	OD OS NO	OD OS NO	OD OS NO	OD OS NO	
10. Do you prefer the right lens or the left lens?	OD OS	OD OS	OD OS	OD OS	OD OS	
	O.D.	O.S.	O.D.	O.S.	O.D.	O.S.
ACUITY:						
DISTANCE R-G WITH SPHERES:						
R-G ACUITY:						
LAG:						
POOLING:						
PERIPHERAL BAND:						
SLIT LAMP EVALUATION:						